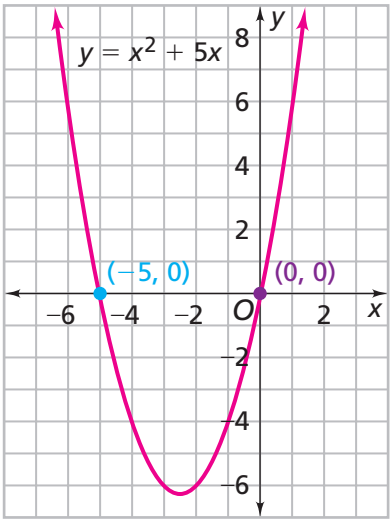
3.3 Factoring Quadratic Expressions

Sometimes mathematical problems that appear to be different are actually the same. Finding the x-intercepts of $y = x^2 + 5x$ is the same as solving $x^2 + 5x = 0$ for x. The *solutions* to $x^2 + 5x = 0$ are also called the *roots* of the equation. In *Frogs, Fleas, and Painted Cubes* you found the solutions or roots by using a table or graph of $y = x^2 + 5x$ as shown.

x	y	
−7	14	
−6	6	
−5	0	← x-intercept or solution
−4	−4	
−3	−6	
−2	−6	
−1	−4	
0	0	← x-intercept or solution
1	6	
2	14	
3	24	



- What is the factored form of $x^2 + 5x$?
- What is the relationship between the factored form of $x^2 + 5x$ and the x-intercepts of the graph of $y = x^2 + 5x$?

Getting Ready for Problem 3.3

To factor the expression $x^2 + 5x + 6$, Trevor draws the area model at the right.

$3x$	6
x^2	$2x$

- Does the model match $x^2 + 5x + 6$?
- Find the factors of $x^2 + 5x + 6$.
- What are the x-intercepts of the graph of $y = x^2 + 5x + 6$?
- Describe the relationship between the x-intercepts of the graph of $y = x^2 + 5x + 6$ and the factored form of $x^2 + 5x + 6$.

Algebra provides tools, such as factoring, that can help solve quadratic equations like $x^2 + 5x = 0$ without using tables or graphs. Before using this tool, you need to review how to write quadratic expressions in factored form.

Problem 3.3 Factoring Quadratic Expressions

A. Jaime suggests the method below to factor $x^2 + 8x + 12$.

- Find factor pairs of 12 such as 1 and 12, 2 and 6, 3 and 4, -1 and -12, -2 and -6, and -3 and -4.
- Pick the factor pair whose sum is 8: $2 + 6 = 8$.
- Write the factored form: $(x + 2)(x + 6)$.

1. Use an area model to show why Jaime's method works for the expression $x^2 + 8x + 12$.

2. Could Jaime have used another factor pair, such as 1 and 12 or 3 and 4, to make an area model for $x^2 + 8x + 12$? Explain.

B. Use a method similar to Jaime's to write each expression in factored form. Show why each factored form is correct.

1. $x^2 + 5x + 4$ **2.** $x^2 - 5x + 4$

3. $x^2 - 3x - 4$ **4.** $x^2 + 4x + 4$

C. 1. Examine the following expressions. How are they similar to and different from those in Question B?

a. $x^2 + 4x$ **b.** $4x^2 + 32x$

c. $6x^2 - 4x$ **d.** $x^2 - 4$

2. Will Jaime's method for factoring work on these expressions? If so, use his method to write them in factored form. If not, find another way to write each in factored form.

D. 1. Examine the following expressions. How are they similar to and different from those in Question B?

a. $2x^2 + 8x + 8$

b. $4x^2 + 4x + 1$

c. $2x^2 + 9x + 4$

2. Will Jaime's method work on these expressions? If so, write them in factored form. If not, find another way to write each in factored form. Explain why your expression is equivalent to the original expression.

ACE **Homework starts on page 45.**